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A NEW PLANT COMMUNITY TYPE IN SOUTHEAST TEXAS RELATED TO BAYGALLS

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ABSTRACT

An area of seep-fed muck bogs paralleling Prairie Branch in Walker County, Texas, has physical and vegetative features most similar to a "baygall," a distinctive and recurring wetland community in the southeastern United States. The Prairie Branch community is dominated by *Viburnum nudum* (possum haw viburnum), *Nyssa sylvatica*, *Myrica cerifera*, *Liquidambar styraciflua*, and *Smilax laurifolia*, but most of the other woody (as well as herbaceous) species characteristic of baygalls are absent. This community is described here as a "possum haw bog," situated at the western edge of the eastern deciduous forest, where it is speculated that decreased precipitation, in part, has correspondingly reduced the potential species diversity of the bog as well as other communities in the vicinity.

KEY WORDS: baygall, possum haw bog, *Viburnum nudum*, community ecology, Texas

Baygalls are a characteristic wetland community of the Atlantic and Gulf Coastal Plains extending into southeastern Texas (Harper 1914; Wells & Shunk 1928; Watson 1979; Christensen 1988; Bridges & Orzell 1989; Harcombe *et al.* 1993; Brooks *et al.* 1993; Weakley *et al.* 1998). They are variable over their range but are generally characterized by such woody species as *Magnolia virginica* (sweet bay) and *Ilex coriacea* (gallberry holly), for which the community is named, *Nyssa sylvatica*, *Rhododendron* spp., *Ilex opaca*, *Acer rubrum*, *Vaccinium* spp., and *Persea palustris*. In western Louisiana and eastern Texas, baygalls generally occur at stream heads or on short slopes that receive enough seepage to be permanently saturated (Bridges & Orzell 1989; Harcombe *et al.* 1993; Brooks *et al.* 1993; Weakley *et al.* 1998). They are recognized as a natural community in both Louisiana (Louisiana Natural Heritage

Program 1988; Weakley *et al.* 1998) and Texas (Diamond *et al.* 1987; Texas Natural Heritage Program 1993; Weakley *et al.* 1998) and have been described for various localities in the West Gulf Coastal Plain (Watson 1979; Ajilvsgi 1979; Nixon *et al.* 1980; Marks & Harcombe 1981; Nixon *et al.* 1983; Matos & Rudolph 1985; Nixon & Ward 1988; Orzell 1990; Martin & Smith 1991; Brooks *et al.* 1993; Grace & Smith 1995; Van Kley in press).

Interest in an area on the north side of Huntsville State Park (Walker County, Texas), connecting the park to Sam Houston National Forest, alerted us to the presence of a plant community with characteristics similar to a baygall. This community, which occurs along Prairie Branch, is described and discussed in the present paper.

SITE DESCRIPTION

Prairie Branch is fed from the spillway of the lower lake of the man-made Elkins Lake complex and flows directly south on private property through a broad but relatively steep-sided channel for slightly more than 1.4 kilometers before entering the northwest side of Huntsville State Park. The stream is the main source of water for Lake Raven in the park. The flow from Elkins Lake is variable, but a large amount of seepage feeds the stream intermittently along its length on the west side and in scattered areas on the east side.

There are three communities paralleling the stream: bottomland, upland, and "bog" (Figure 1).

Bottomland. Along the creek, mostly about 15 to 50 meters but up to 100 m to either side of it, the alluvium is relatively firm and flat, and the area has physical and vegetative characteristics intermediate between riparian and bottomland communities. The canopy is essentially closed and includes *Nyssa sylvatica*, *Ulmus americana*, *Acer rubrum*, *Liquidambar styraciflua*, *Quercus phellos*, *Fraxinus pennsylvanica*, *Betula nigra*, *Platanus occidentalis*, *Populus deltoides*, *Acer negundo*, and *Salix nigra*. *Carpinus caroliniana* is abundant in the midstory. Characteristic tree species associated with east Texas bottomlands of larger river systems (e.g., *Quercus pagoda*, *Quercus lyrata*, *Carya aquatica*, *Celtis laevigata*, and *Ulmus crassifolia*) are absent along Prairie Branch. The understory is open and few shrubs are present. *Ilex vomitoria* is relatively common but scattered. Characteristic herbaceous species are *Saururus cernuus*, *Hydrocotyle verticillata*, *Poa autumnalis*, *Triadenum walteri*, *Callitriche heterophylla*, *Gratiola virginiana*, *Polygonum hydropiperoides*, *Tovara virginiana*, *Duchesnea indica*, *Chasmanthium latifolium*, *Carex flaccosperma*, *Carex retroflexa*, and *Carex blanda*, and species of *Juncus* and *Rhynchospora*. The ferns *Thelypteris kunthii* and *Onoclea sensibilis* are common near the stream. Two uncommon species are *Hottonia inflata* and *Listera australis*.

Upland. Ridges paralleling Prairie Branch on both its east and west sides rise to about 23 meters above the stream channel. Slopes toward the stream range about 3-8 percent. The ridges and upland margins on both sides of the creek are Alfisols -- sandy above with increasing clay below (McClintock 1979). The slopes bordering

and above the bog's edge where the seeps begin are vegetated by a mixed pine-hardwood community typical of the area. The largest and most numerous trees are *Quercus nigra*, with other species mixed in various proportions: *Quercus falcata*, *Nyssa sylvatica*, *Liquidambar styraciflua*, *Ulmus alata*, *Carya texana*, and various individuals apparently intermediate between *Quercus stellata* and *Q. margarettiae*. Most of the larger pines have been removed for timber, but both *Pinus taeda* (more common) and *P. echinata* are found throughout. The most common smaller trees and shrubs are *Cornus florida* and *Sassafras albidum*, mixed with *Morus rubra*, *Viburnum rufidulum*, *Ilex vomitoria*, *Rhamnus caroliniana*, *Ilex opaca*, and *Ilex longipes*. *Carpinus caroliniana* is common along the lower parts of the slope. *Chasmanthium sessiliflorum* is the most common and abundant herbaceous species. *Smilax rotundifolia* is a common vine.

Bog (seepage areas). At the lower slopes of the upland before it flattens out into the stream bottom are a series of linear seepages that parallel the stream. Their slope is 1-3 percent, varying in width from a few dozen meters to perhaps 50 m and extending in places to within 20 m of the stream. On the west side of Prairie Branch they apparently are continuous but are sporadic and reduced in size on the east side. The seeps were flowing and the soil saturated on 18 June 1998, after more than two months of severe drought in the area. The presence of obligate hydrophytes further suggests that seepage occurs all year. The soils are described as Depcor-Huntsburg-Gunter association, which is a combination of Alfisols and Ultisols (McClintock 1979). These wet areas support a dense thicket of low shrubs, bamboo vine (*Smilax laurifolia*), and taller canopy trees, similar in appearance to tall pocosins (Richardson & Gibbons 1993). Much of the midstory and understory shrubs barely reach a height of 3-5 meters. *Nyssa sylvatica* and *Liquidambar* overtop the shrub layer but do not form a continuous canopy. *Nyssa* is the most common tree species along the upper margins of the seepage areas. Timber has been periodically removed from the uplands and bottomland in the immediate area, but the bog otherwise apparently exists under relatively natural conditions.

Many of the taller trees in the bog are scattered "snags" of individuals (apparently *Nyssa*) that died relatively recently, the cause of death not known but perhaps connected with effects of timber removal along adjacent slopes. Large loblolly pines were recently removed (ca. 1993-1994) from the uplands as well as from along the immediate bog and seep margins, as evidenced by scattered stumps, and this may have affected water flow, increasing seepage and resulting in stress to larger trees.

It is likely that this bog once extended from what is now upper Elkins Lake downstream through Prairie Branch into the bottoms now inundated by Lake Raven in Huntsville State Park. A small remnant of the same bog community exists within the state park at the upper reach of the eastern arm of the lake, near the entrance of Little Chinquapin Creek. The remaining portion of this habitat, along Prairie Branch, is about 25% of what probably was the original bog. The Prairie Branch site is the only known habitat in Walker County similar to a baygall in topography and hydrology. Parts of the next drainage system to the west, which roughly parallels Prairie Branch, are about 15 m higher than Prairie Branch and may significantly contribute to the seepage water. Drainage east of Prairie Branch is lower in elevation.

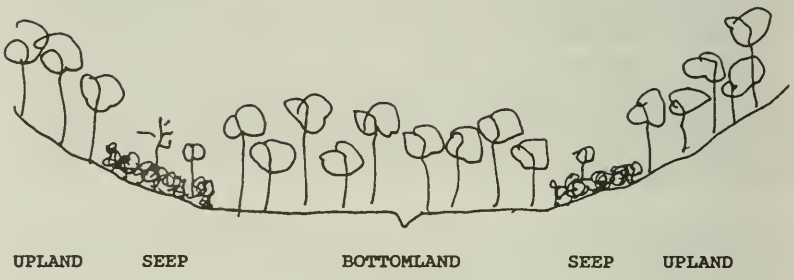

Figure 1. Profile of Prairie Branch.

METHODS

We made several trips to Prairie Branch for observations and collections. On 18 June, 1998, we analyzed five 5 × 5 meter quadrats within the bog. Sites were selected according to accessibility and soil moisture, and ranged from permanently saturated sands to slurry-muck, apparently representing the whole range of moisture conditions. Frequency and diameter of all woody species with a dbh of 2 cm or greater were recorded. Herbaceous species presence was described by identifying all species in the plots; herbaceous cover was measured and percent cover estimated for major species. Percent canopy cover also was estimated. Voucher collections for species are deposited at SHST and TEX. Plant nomenclature follows Jones *et al.* (1997) and Kartesz (1994); scientific authorities for all names used in this paper can be read from these references. A soil sample was collected from the upper 15 cm of each of the five plots and analyzed by A & L Laboratories, Memphis, Tennessee. Organic matter was determined by the combustion method.

RESULTS

Table 1 summarizes the larger woody vegetation in the five plots. *Viburnum nudum* dominated in number of individuals, followed by *Nyssa sylvatica*, *Myrica cerifera*, and *Liquidambar styraciflua*. However, since it never exceeded 3.5 cm dbh, *Viburnum nudum* contributed relatively less to the total basal area than did *Nyssa* or *Liquidambar*. *Smilax laurifolia* was present in large numbers but since the stems were always less than 2 cm diameter, this species is not listed among those in Table 1.

Table 2 summarizes the relative frequency of herbaceous species in the plots. Ten vascular species occurred in all the plots, 6 species in four plots, 8 in three, 9 in two, and 17 in one. A species of liverwort was present in all plots. Fifty vascular and one non-vascular species were identified for the plots during the 18 June survey. About half of these are monocots, with Cyperaceae especially well-represented.

Table 3 gives the percent of herbaceous cover by dominant species in each plot. Only species accounting for 1% or more are included. Cover ranged from 40% to 100%. Monocots and ferns clearly dominated. Canopy cover for the five plots ranged from 20% to 95% but was not correlated with ground cover percentages.

Table 4 gives information on soil samples from the five sample sites. The soils are acidic and low in nutrients and organic matter, falling within the normal range of soil chemistry of baygalls of east Texas and west Louisiana (Hartman 1974; Nixon *et al.* 1980; Nixon & Ward 1988; MacRoberts unpubl.).

DISCUSSION

The seepage areas along Prairie Branch have the physical features and some of the vegetative appearance of baygalls, but most of the typical woody species of baygalls

Table 1. Dominant woody species.

SPECIES	NUMBER OF INDIVIDUALS	TOTAL DIAMETER (cm)	MEAN DIAMETER (cm)	RANGE (cm)
Viburnum nudum	45	105.5	2.3	2.0-3.5
Nyssa sylvatica	23	140.5	6.1	2-20
Myrica cerifera	17	65.0	3.8	2-18
Liquidambar styraciflua	13	111.0	8.5	2-16
Pinus taeda	1	2.0	2.0	2.0
Ulmus rubra	1	3.5	3.5	3.5

Table 2. Species plot occurrence.

SPECIES	OCCURRENCE BY PLOT
Viburnum nudum	12345
Smilax laurifolia	12345
Nyssa sylvatica	12345
Myrica cerifera	12345
Liquidambar styraciflua	12345
Woodwardia areolata	12345
Rhynchospora miliacea	12345
Boehmeria cylindrica	12345
Dichanthelium lindheimeri	12345
Mikania scandens	12345
liverwort	12345
Smilax bona-nox	1234
Hypericum mutilum	1234
Triadenum walteri	1235
Hydrocotyle verticillata	1235
Eleocharis acicularis	1245
Ludwigia palustris	1245
Carex leptalea	123
Chasmanthium laxum	125
Lycopus rubellus	135
Osmunda regalis	245
Eleocharis tortilis	245
Polygonum hydropiperoides	245
Eupatorium compositifolium	245
Juncus effusus	345

Table 2. (cont.).

SPECIES	OCCURRENCE BY PLOT
Osmunda cinnamomea	13
Stachys sp.	23
Quercus nigra	24
Cyperus virens	45
Rhynchospora caduca	45
Rhynchospora corniculata	45
Carex debilis	45
Carex frankii	45
Juncus coriaceus	45
Cyperus thyrsiflorus	1
Acer rubrum	1
Juncus tenuis	1
Ulmus rubra	2
Pinus taeda	2
Micranthemum umbrosum	3
Ptlimnium nuttallii	3
Saururus cernuus	3
Carex lurida	4
Juncus diffusissimus	4
Juncus validus	4
Ludwigia glandulosa	4
Pluchea camphorata	4
Eupatorium perfoliatum	4
Onoclea sensibilis	4
Carex tribuloides	5
Athyrium felix–femina	5

are absent. Conspicuously missing are *Magnolia virginiana* and *Nyssa biflora* (two main components of baygall canopies), *Ilex coriacea, Persea palustris, Persea borbonia, Aronia arbutifolia, Cyrilla racemiflora, Itea virginica, Alnus serrulata,* and others. Instead, a minor baygall species, *Viburnum nudum,* a shrub seldom reaching six meters in height and whose stems are generally only 2-3 cm in diameter, is a major dominant. Also missing are rare, small baygall herbs such as *Burmannia biflora, Apteria aphylla, Mayaca fluviatilis, Habenaria repens, Habenaria clavellata,* and *Pogonia ophioglossoides. Sphagnum,* which can be common in typical baygalls, occurs only in limited quantity along some of the Prairie Branch marginal seeps.

We considered referring to the Prairie Branch bog as a "depauperate" baygall because of its lack of species typical of that community but it is so floristically

Table 3. Percent herbaceous cover.

SPECIES	% COVER
PLOT 1	
Woodwardia areolata	15
Rhynchospora miliacea	10
Chasmanthium laxum	7
Carex leptalea	3
Ludwigia palustris	3
liverwort	2
TOTAL	40%
PLOT 2	
Woodwardia areolata	40
Rhynchospora miliacea	5
Chasmanthium laxum	5
Eleocharis tortilis	3
Ludwigia palustris	3
Polygonum hydropiperoides	2
Triadenum walteri	1
liverwort	1
TOTAL	60%
PLOT 3	
Rhynchospora miliacea	30
Osmunda cinnamomea	20
Woodwardia areolata	15
Carex leptalea	10
Viburnum nudum	10
Boehmeria cylindrica	5
Saururus cernuus	5
Triadenum walteri	3
Dichanthelium lindheimeri	2
TOTAL	100%
PLOT 4	
Chasmanthium laxum	20
Carex frankii	15
Rhynchospora miliacea	15
Juncus coriaceus	10
Carex debilis	5
Dichanthelium lindheimeri	5
Juncus diffusissimus	5
Rhynchospora corniculata	5

Table 3. (cont.).

SPECIES	% COVER
PLOT 4 (cont.)	
Woodwardia areolata	5
Pluchea camphorata	3
Rhynchospora caduca	2
TOTAL	90%
PLOT 5	
Carex frankii	20
Polygonum hydropiperoides	8
Chasmanthium laxum	6
Athyrium felix–femina	5
Rhynchospora miliacea	5
Eleocharis tortilis	3
Osmunda regalis	2
Ludwigia palustris	2
Hydrocotyle verticillata	2
Rhynchospora caduca	2
TOTAL	55%

Table 4. Soil chemistry.

SAMPLE		EXCHANGEABLE IONS (PPM)				
	pH	P	K	Ca	Mg	OM%
Plot 1	5.2	6	36	461	91	2.8
Plot 2	5.0	10	72	782	118	3.9
Plot 3	5.2	12	42	764	133	4.6
Plot 4	4.6	5	26	210	34	1.8
Plot 5	4.7	6	41	517	84	3.7

distinctive that it is misleading to think of it as a baygall. We instead refer to it here as a "possum haw bog."

In San Jacinto County, immediately adjacent to Walker County and less than 50 km (30 miles) southeastward, habitats similar to the Prairie Branch bog are populated by large complements of typical baygall species (Hartman 1974; Nesom pers. observ.; Turner *et al.* in prep.). Brooks *et al.* (1993) studied 20 baygall sites along a north-south axis in eastern Texas. These ran from southern Rusk County south to Hardin and Tyler counties and as far east as Newton County; the closest of these to the Prairie Branch bog was in Tyler County. All are much more similar to the San Jacinto

County baygalls than to the Prairie Branch bog. *Viburnum nudum* was only a minor component at their 20 sites. Clearly, a study similar to that of Brooks *et al.* made along an east-west axis, including western Louisiana, would be valuable.

The possum haw bog and the Big Thicket

The relationship of the floristically depauperate Prairie Branch bog to typical baygalls apparently is analogous to the relationship between the flora of Walker County and that of the southeast Texas Big Thicket. "[The] Baygall-Palmetto Flat complex is considered the heart of the Traditional Thicket and gave this area the name 'Big Thicket' . . . Of all the plant communities of the Big Thicket area, the Acid Bog-Baygall best represents the Traditional Thicket" (Watson 1979). Various authors have included Walker County within the Big Thicket (*e.g.*, Parks & Cory 1936), but using a set of indicator species to define its boundary, McLeod (1971) excluded Walker County from the area. Indeed, a sharp and easily perceptible change occurs near the boundary between San Jacinto County, which has Big Thicket species and vegetation by any definition, and the southeastern corner of Walker County.

Many woody species characteristic of the Big Thicket and the eastern United States drop completely out of the flora in the westward transition into Walker County (Simpson 1988; Burns & Honkala 1990; Nesom 1998; Nesom & Brown in prep.): *Fagus grandifolia, Quercus laurifolia, Pinus palustris, Myrica heterophylla, Magnolia virginiana, Ilex coriacea, Persea palustris, Viburnum acerifolium, Asimina parvifolia, Sebastiania fruticosa, Symplocos tinctoria, Aronia arbutifolia, Clethra alnifolia, Cyrilla racemiflora*, and *Itea virginica.* Among the most characteristic species of moist upland forests in the Big Thicket area of San Jacinto County are the shrubs *Viburnum acerifolium, Asimina parvifolia,* and *Persea borbonia.* and the herbaceous *Smilax pumila.* Neither the *Viburnum* nor *Asimina* is known from Walker County, and the latter two species are rare there.

Additionally, a number of other native tree species reach the western boundary of their geographic range within Walker County, where some of them are common before disappearing entirely only a few more miles to the west: *Liquidambar styraciflua, Acer rubrum, Quercus velutina, Quercus alba, Carpinus caroliniana, Ostrya virginiana, Sassafras albidum*, and *Chionanthus virginicus. Magnolia grandiflora, Carya myristiciformis, Quercus michauxii, Hamamelis virginiana, Castanea pumila, Styrax americana, Halesia diptera,* and *Rhododendron canescens* are rare in Walker County, their last outpost westward. Other tree species are very near their western distributional boundary in Walker County (for example): *Pinus echinata, Pinus taeda, Cornus florida, Nyssa sylvatica, Diospyros virginiana, Carya cordiformis, Carya aquatica, Betula nigra, Quercus falcata, Quercus phellos*, and *Quercus lyrata.*

The predominance of clay soils in western Walker County and further west is surely connected with this abrupt limitation of species distributions, but other limiting environmental factors are not so clear or sharply defined. Braun (1950), however, noted that "decreasing precipitation and longer and more frequent droughts" were the primary limitations to westward spread of the deciduous forest, and it seems likely that the prolonged, high seasonal temperatures in southeast Texas have a strong effect in limiting the water available to plants. The annual average 112 cm/44 in of precipitation in Huntsville/Walker County (Larkin & Bomar 1983), rapidly depleted by the prolonged

heat, probably approaches the minimal amount required by many woody species of this area. Rainfall increases quickly eastward from Huntsville (ca. 117 cm/46 in -- Coldspring/San Jacinto County [40 km eastward]; 122 cm/48 in -- Livingston/Polk County [60 km eastward]; 132 cm/52 in -- Jasper/Jasper County [150 km eastward) and decreases to the west (99 cm/39 in -- College Station/Brazos County [80 km westward]; 91 cm/36 in -- Bastrop/ Bastrop County [160 km westward]; 81 cm/32 in -- Austin/Travis County [210 km westward]).

Along Prairie Branch, why should only *Viburnum nudum* occur, one of many shrubby, characteristic baygall species that appear to be strictly true to this constantly wet stream bottom habitat? Perhaps plants of possum haw are more tolerant to occasional drought, but then the species might be expected to occur in a broader range of habitats, which it does not. Possum haw and bamboo vine have reached Prairie Branch relatively recently through dispersal from baygalls in more eastern sites, or the Prairie Branch site may be floristically depleted from earlier, more typical, western baygalls.

A possum haw bog in Anderson County

We report here another east Texas bog that is floristically and physically similar to the Prairie Branch site. On July 30, 1998, the two MacRoberts examined a "baygall" at the western end of Andrew's Bog in the Engeling Wildlife Management Area, Anderson County, about 150 kilometers north of Prairie Branch in the Post Oak Savanna region of Texas. Like the Prairie Branch site, Andrew's Bog is at the edge of the Eastern Deciduous Forest.

The midstory and overstory were dominated by *Viburnum nudum*, *Nyssa sylvatica*, *Myrica cerifera*, and *Liquidambar styraciflua*, with scattered individuals of *Acer rubrum*. As at Prairie Branch, the Andrew's Bog site had no *Magnolia*, *Persea*, or *Ilex coriacea*; neither was there any *Smilax laurifolia*, although there was a small amount of *Smilax bona-nox*. The ground cover was somewhat different from that at Prairie Branch. Ferns dominated, notably *Woodwardia areolata* and *Osmunda cinnamomea*, with some *Osmunda regalis*. *Sphagnum* and liverworts were common. Other species present were *Chasmanthium laxum*, *Saururus cernuus*, *Athyrium felix-femina*, *Eleocharis* spp., *Rhynchospora* spp., and *Carex* spp., the latter two genera in fewer species and in fewer numbers than at Prairie Branch. As at Prairie Branch, none of the rare, small baygall herbs mentioned above were present.

The Andrew's Bog site is at the lower slope of a deep sand hill, topographically similar to Prairie Branch. The Andrew's Bog soils also were similar to those at Prairie Branch – deep wet muck – even though the area was in severe drought.

The environmental variables of biological importance in this region at the very edge of the Eastern Forest have not been fully explored (Owen & Schmidly 1986), and many interesting possibilities exist for studying the plant ecology in this area of sharp transition. Bog sites are scattered westward in Texas as far as the eastern edge of the Edwards Plateau, and characterization of these may provide insight into the nature and origin of the communities in Walker County and Andrews County. We hope that at least representative natural communities will remain intact enough to allow this.

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